ASTHMA IN CHILDREN: AN UPDATE

GINA Global Strategy for Asthma Management and Prevention 2017

PRESENTED BY:

HUMBERTO A. HIDALGO, M.D., M.S
CLINICAL ASSOCIATE PROFESSOR OF PEDIATRICS
CLINICAL VICE CHAIR, PEDIATRICS
THE UNIVERSITY OF TEXAS RIO GRANDE VALLEY

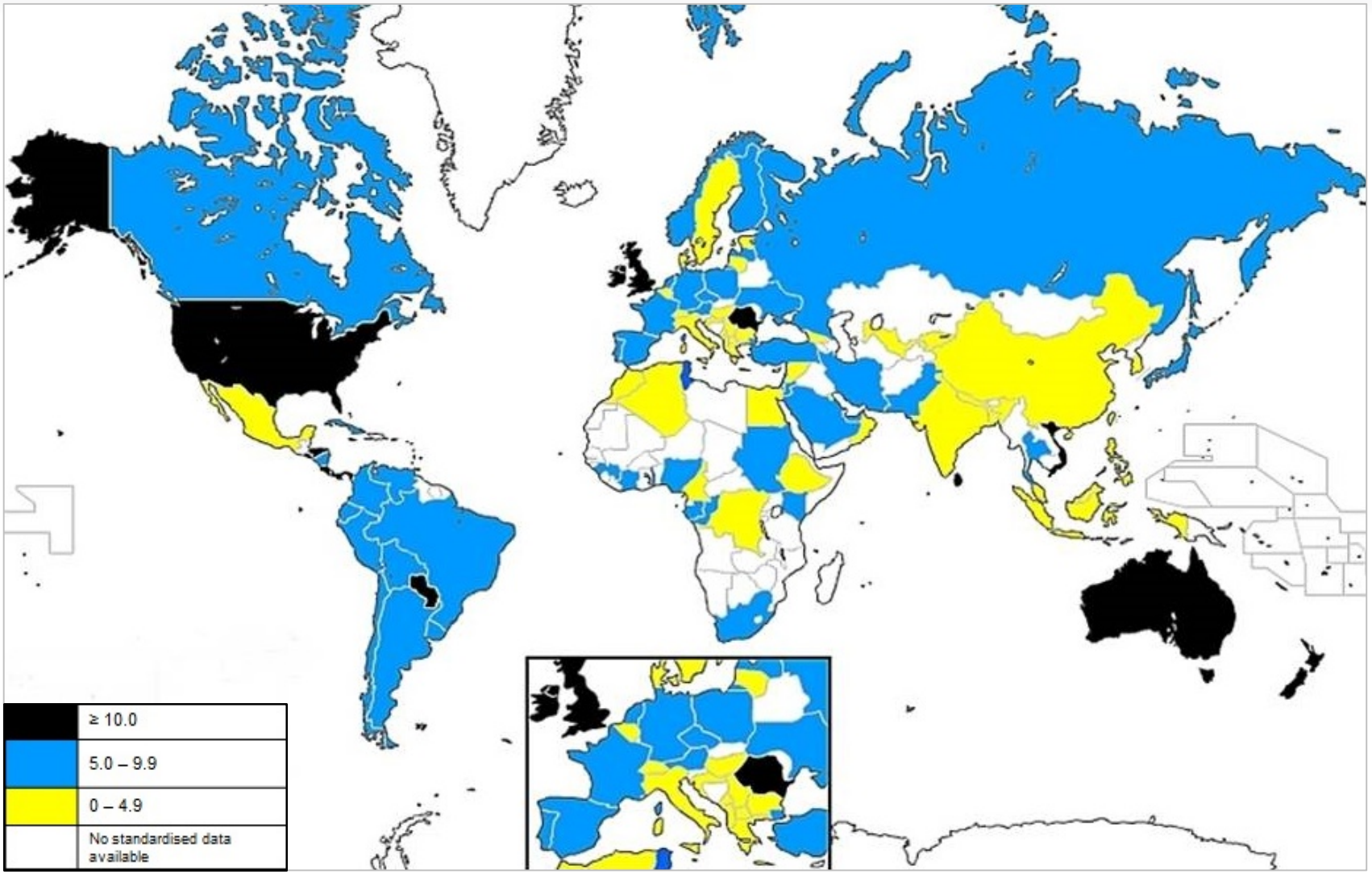
WHAT WE ARE GOING TO COVER:
OUTPATIENT CARE OF CHRONIC ASTHMA

- RECOGNIZE COMMON SYMPTOM PATTERNS AND SIGNS OF ASTHMA IN CHILDHOOD
- KNOW HOW TO ASSESS ASTHMA CONTROL FROM ONGOING SYMPTOMS AND RISK
- UNDERSTAND HOW THE CONTROL-BASED “ASTHMA MANAGEMENT CYCLE” WORKS
- RECOGNIZE THE SPECIAL DIAGNOSIS/MANAGEMENT ISSUES IN CHILDREN LESS THAN 5-YEARS-OLD

Burden of asthma

- Asthma is one of the most common chronic diseases worldwide with an estimated 300-million affected individuals
- Prevalence is increasing in many countries, especially in children
- Asthma is a major cause of school and work absence
- Health care expenditure on asthma is very high
  - Developed economies might expect to spend 1-2 percent of total health care expenditures on asthma.
  - Developing economies likely to face increased demand due to increasing prevalence of asthma
  - Poorly controlled asthma is expensive
  - However, investment in prevention medication is likely to yield cost savings in emergency care

Prevalence of asthma in children aged 13-14 years



GINA 2017 Appendix Box A1-1; figure provided by R Beasley

What is known about asthma?

- Asthma is a common and potentially serious chronic disease that can be controlled but not cured
- Asthma causes symptoms such as wheezing, shortness of breath, chest tightness and cough that vary over time in their occurrence, frequency and intensity
- Symptoms are associated with variable expiratory airflow, i.e. difficulty breathing air out of the lungs due to
  - Bronchoconstriction (airway narrowing)
  - Airway wall thickening
  - Increased mucus
- Symptoms may be triggered or worsened by factors such as viral infections, allergens, tobacco smoke, exercise and stress

What is known about asthma?

- Asthma can be effectively treated
- When asthma is well-controlled, patients can
  - ✓ Avoid troublesome symptoms during the day and night
  - ✓ Need little or no reliever medication
  - ✓ Have productive, physically active lives
  - ✓ Have normal or near-normal lung function
  - ✓ Avoid serious asthma flare-ups (also called exacerbations, or severe attacks)

Definition of asthma

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation.

It is defined by the history of respiratory symptoms such as wheeze, shortness of breath, chest tightness and cough that vary over time and in intensity, together with variable expiratory airflow limitation.

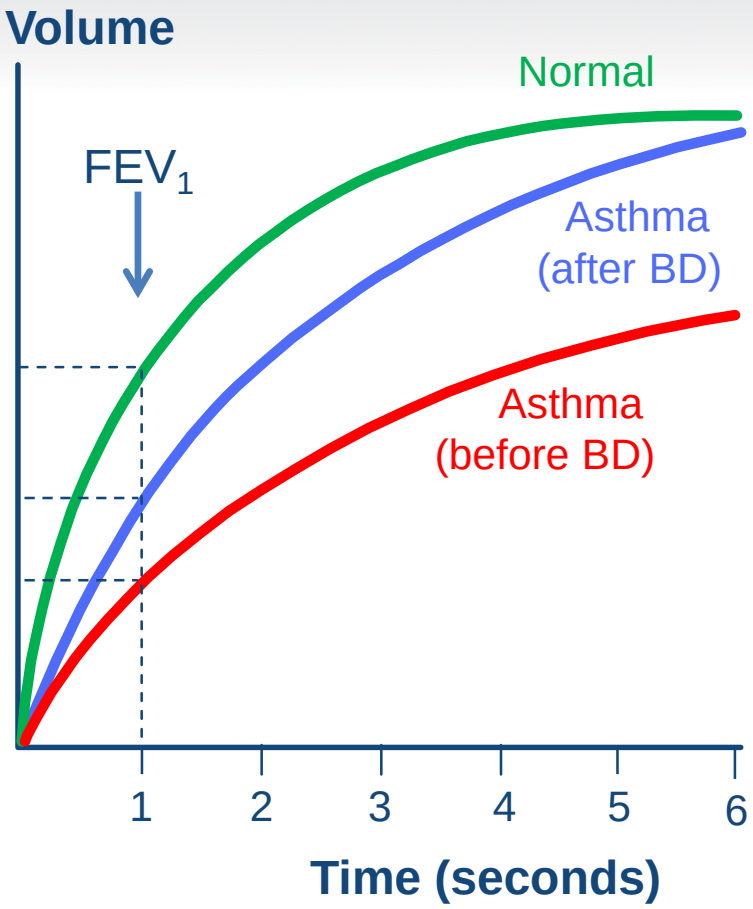
Diagnosis of asthma

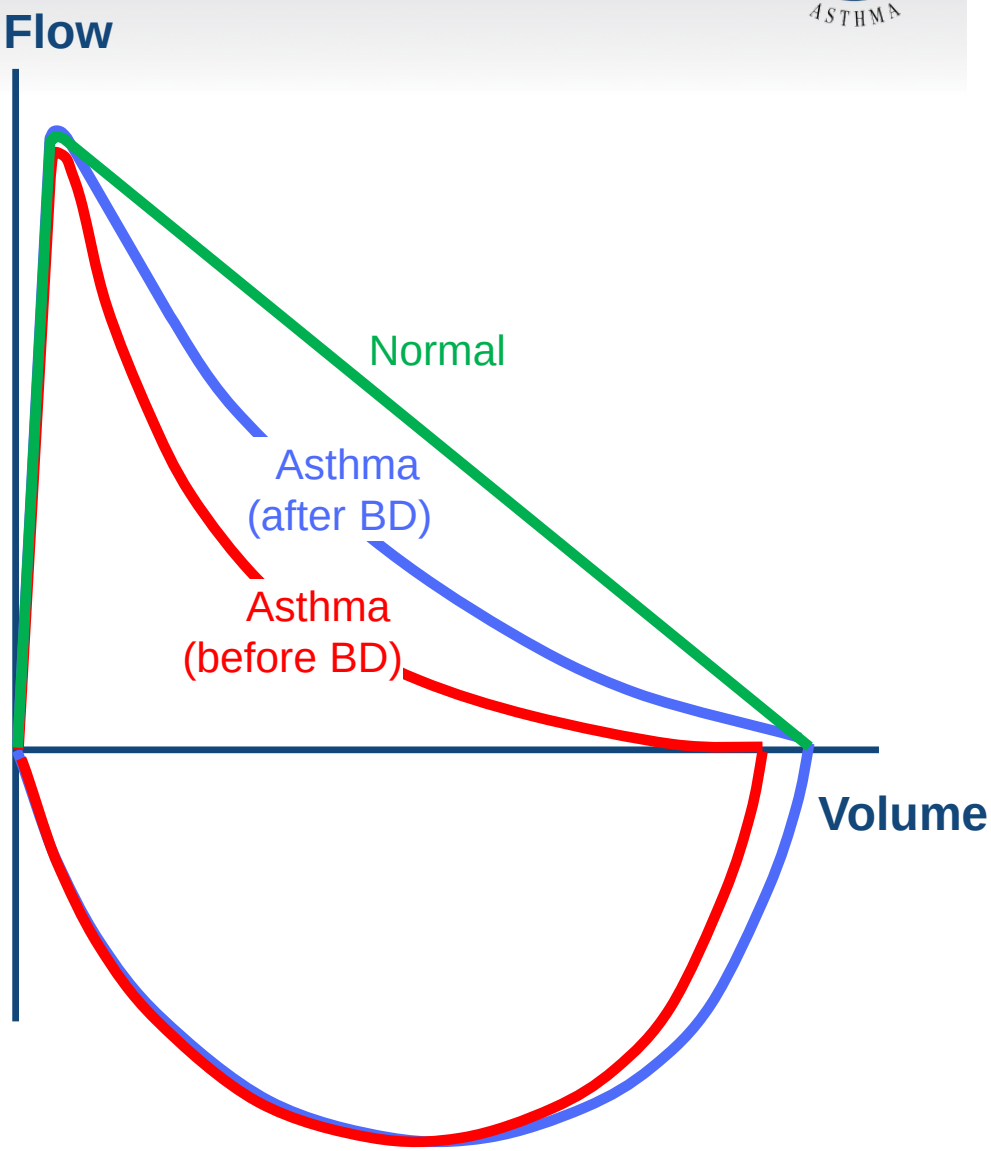
- The diagnosis of asthma should be based on:
  - A history of characteristic symptom patterns
  - Evidence of variable airflow limitation, from bronchodilator reversibility testing or other tests
- Document evidence for the diagnosis in the patient's notes, preferably before starting controller treatment
  - It is often more difficult to confirm the diagnosis after treatment has been started
- Asthma is usually characterized by airway inflammation and airway hyperresponsiveness, but these are not necessary or sufficient to make the diagnosis of asthma.

Diagnosis of asthma – symptoms

- *Increased* probability that symptoms are due to asthma if:
  - More than one type of symptom (wheeze, shortness of breath, cough, chest tightness)
  - Symptoms often worse at night or in the early morning
  - Symptoms vary over time and in intensity
  - Symptoms are triggered by viral infections, exercise, allergen exposure, changes in weather, laughter, irritants such as car exhaust fumes, smoke, or strong smells
- *Decreased* probability that symptoms are due to asthma if:
  - Isolated cough with no other respiratory symptoms
  - Chronic production of sputum
  - Shortness of breath associated with dizziness, light-headedness or peripheral tingling
  - Chest pain
  - Exercise-induced dyspnea with noisy inspiration (stridor)

Typical spirometric tracings





Note: Each FEV_1 represents the highest of three reproducible measurements

Diagnosis of asthma – physical examination

- Physical examination in people with asthma
  - Often normal
  - The most frequent finding is wheezing on auscultation, especially on forced expiration
- Wheezing is also found in other conditions, for example:
  - Respiratory infections
  - COPD
  - Upper airway dysfunction
  - Endobronchial obstruction
  - Inhaled foreign body
- Wheezing may be absent during severe asthma exacerbations (‘silent chest’)

Assessment of asthma

1. Asthma control - two domains
   - Assess symptom control over the last 4 weeks
   - Assess risk factors for poor outcomes, including low lung function
2. Treatment issues
   - Check inhaler technique and adherence
   - Ask about side-effects
   - Does the patient have a written asthma action plan?
   - What are the patient's attitudes and goals for their asthma?
3. Comorbidities
   - Think of rhinosinusitis, GERD, obesity, obstructive sleep apnea, depression, anxiety
   - These may contribute to symptoms and poor quality of life

GINA assessment of asthma control

A. Symptom control

Level of asthma symptom control

In the past 4 weeks, has the patient had:		Well-controlled	Partly controlled	Uncontrolled
• Daytime asthma symptoms more than twice a week?	Yes ❑ No ❑	None of these	1-2 of these	3-4 of these
• Any night waking due to asthma?	Yes ❑ No ❑			
• Reliever needed for symptoms* more than twice a week?	Yes ❑ No ❑			
• Any activity limitation due to asthma?	Yes ❑ No ❑			

B. Risk factors for poor asthma outcomes

- Assess risk factors at diagnosis and periodically
- Measure FEV_1 at start of treatment, after 3 to 6 months of treatment to record the patient's personal best, then periodically for ongoing risk assessment

ASSESS PATIENT'S RISKS FOR:

- Exacerbations
- Fixed airflow limitation
- Medication side-effects

Assessment of risk factors for poor asthma outcomes

Risk factors for exacerbations include:

- Uncontrolled asthma symptoms

Additional risk factors, even if the patient has few symptoms:

- High SABA use (≥3 canisters/year)
- Having ≥1 exacerbation in last 12 months
- Low FEV_1; higher bronchodilator reversibility
- Incorrect inhaler technique and/or poor adherence
- Smoking
- Obesity, chronic rhinosinusitis, pregnancy, blood eosinophilia
- Elevated FeNO in adults with allergic asthma taking ICS
- Ever intubated for asthma

Risk factors for fixed airflow limitation include:

- No ICS treatment, smoking, occupational exposure, mucus hypersecretion, blood eosinophilia; pre-term birth, low birth weight

Risk factors for medication side-effects include:

- Frequent oral steroids, high dose/potent ICS, P450 inhibitors

Assessing asthma severity

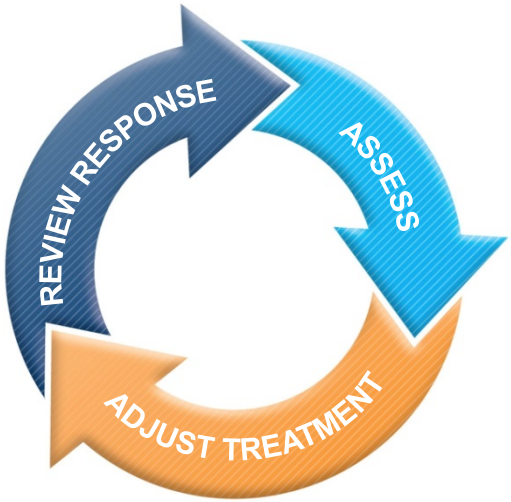
- How?
  - Asthma severity is assessed retrospectively from the level of treatment required to control symptoms and exacerbations
- When?
  - Assess asthma severity after patient has been on controller treatment for several months
  - Severity is not static – it may change over months or years, or as different treatments become available
- Categories of asthma severity
  - *Mild asthma:* well-controlled with Steps 1 or 2 (as-needed SABA or low dose ICS)
  - *Moderate asthma:* well-controlled with Step 3 (low-dose ICS/LABA)
  - *Severe asthma:* requires Step 4/5 (moderate or high dose ICS/LABA ± add-on), or remains uncontrolled despite this treatment

Goals of asthma management

- The long-term goals of asthma management are
  1. **Symptom control**: to achieve good control of symptoms and maintain normal activity levels
  2. **Risk reduction**: to minimize future risk of exacerbations, fixed airflow limitation and medication side-effects
- Achieving these goals requires a partnership between patient and their health care providers
  - Ask the patient about their own goals regarding their asthma
  - Good communication strategies are essential
  - Consider the health care system, medication availability, cultural and personal preferences and health literacy

Treating to control symptoms and minimize risk

- Establish a patient-doctor partnership
- Manage asthma in a continuous cycle:
  - **Assess**
  - **Adjust** treatment (pharmacological and non-pharmacological)
  - **Review** the response
- Teach and reinforce essential skills
  - Inhaler skills
  - Adherence
  - Guided self-management education
    - Written asthma action plan
    - Self-monitoring
    - Regular medical review



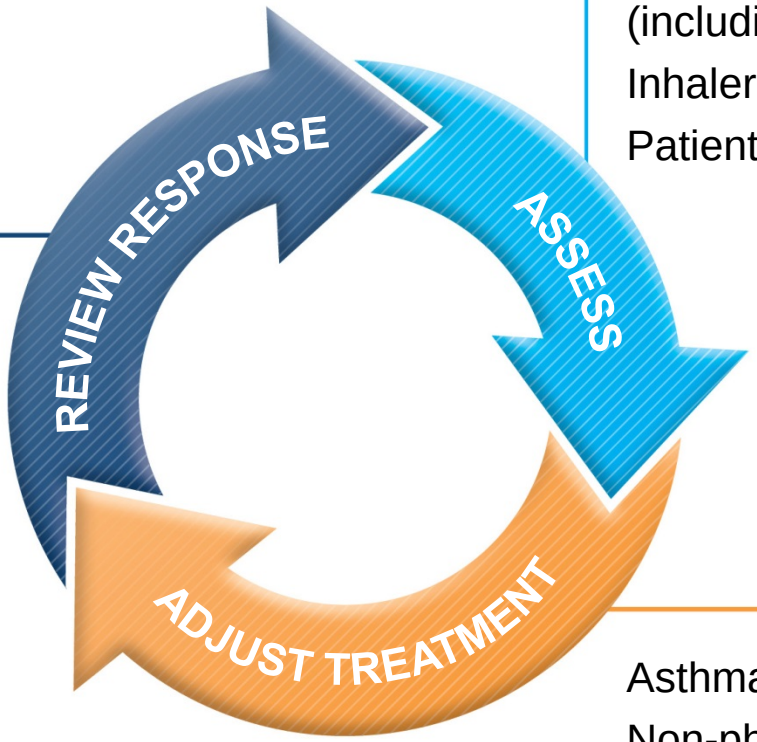
The control-based asthma management cycle

Diagnosis

Symptom control & risk factors (including lung function)

Inhaler technique & adherence

Patient preference



Symptoms

Exacerbations

Side-effects

Patient satisfaction

Lung function

Asthma medications

Non-pharmacological strategies

Treat modifiable risk factors

Initial controller treatment for adults, adolescents and children 6–11 years

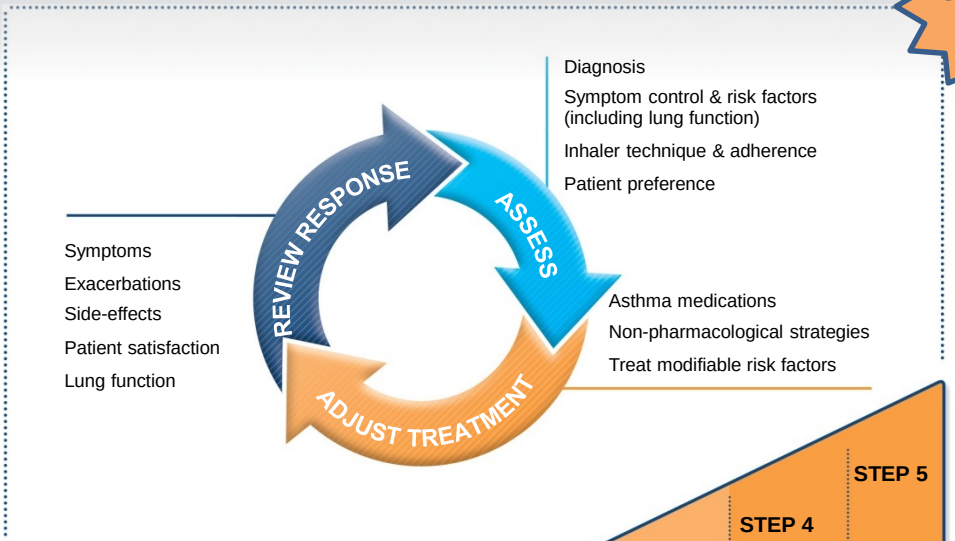
- Start controller treatment early
  - For best outcomes, initiate controller treatment as early as possible after making the diagnosis of asthma
- Indications for regular low-dose ICS - any of:
  - Asthma symptoms more than twice a month
  - Waking due to asthma more than once a month
  - Any asthma symptoms plus any risk factors for exacerbations
- Consider starting at a higher step if:
  - Troublesome asthma symptoms on most days
  - Waking from asthma once or more a week, especially if any risk factors for exacerbations
- If initial asthma presentation is with an exacerbation:
  - Give a short course of oral steroids and start regular controller treatment (e.g. high dose ICS or medium dose ICS/LABA, then step down)

Initial controller treatment

- Before starting initial controller treatment
  - Record evidence for diagnosis of asthma, if possible
  - Record symptom control and risk factors, including lung function
  - Consider factors affecting choice of treatment for this patient
  - Ensure that the patient can use the inhaler correctly
  - Schedule an appointment for a follow-up visit
- After starting initial controller treatment
  - Review response after 2-3 months, or according to clinical urgency
  - Adjust treatment (including non-pharmacological treatments)
  - Consider stepping down when asthma has been well-controlled for 3 months

Stepwise approach to control asthma symptoms and reduce risk

UPDATED 2017



	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
PREFERRED CONTROLLER CHOICE		Low dose ICS	Low dose ICS/LABA**	Med/high ICS/LABA	Refer for add-on treatment e.g. tiotropium,*† anti-IgE, anti-IL5*
Other controller options	*Consider low dose ICS*	*Leukotriene receptor antagonists (LTRA) Low dose theophylline**	*Med/high dose ICS Low dose ICS+LTRA (or + theoph*)*	*Add tiotropium*† High dose ICS + LTRA (or + theoph*)*	*Add low dose OCS*
RELIEVER	As-needed short-acting beta$_2$-agonist (SABA)		As-needed SABA or low dose ICS/formoterol#		

REMEMBER TO...

- Provide guided self-management education (self-monitoring + written action plan + regular review)
- Treat modifiable risk factors and comorbidities, e.g. smoking, obesity, anxiety
- Advise about non-pharmacological therapies and strategies, e.g. physical activity, weight loss, avoidance of sensitizers where appropriate
- Consider stepping up if … uncontrolled symptoms, exacerbations or risks, but check diagnosis, inhaler technique and adherence first
- Consider adding SLIT in adult HDM-sensitive patients with allergic rhinitis who have exacerbations despite ICS treatment, provided FEV1 is >70% predicted
- Consider stepping down if … symptoms controlled for 3 months + low risk for exacerbations. Ceasing ICS is not advised.

Treatment steps – changes in 2018

- Step 1
  - It is explained that the reason ICS should be considered for patients with mild asthma (rather than prescribing SABA alone) is to reduce their risk of serious exacerbations *(Pauwels, Lancet 2003; O'Byrne AJRCCM 2001; Reddel Lancet 2017)*
- Steps 3-4
  - From the large FDA LABA safety studies: adding LABA to ICS in a combination inhaler reduces risk of exacerbations and improves symptoms and lung function, compared with the same dose of ICS alone, but with only a small reduction in reliever use *(Stempel NEJM 2016, Peters NEJM 2016)*
- Step 5 and Box 3-14: management of severe asthma
  - Subcutaneous benralizumab (monoclonal anti-IL5 receptor α antibody) is another add-on treatment for patients aged ≥12 years with severe eosinophilic asthma

Step 1 – as-needed reliever inhaler

- Preferred option: as-needed inhaled short-acting beta$_2$-agonist (SABA)
  - SABAs are highly effective for relief of asthma symptoms
  - However …. there is insufficient evidence about the safety of treating asthma with SABA alone
  - This option should be reserved for patients with infrequent symptoms (less than twice a month) of short duration, and with no risk factors for exacerbations
- Other options
  - Consider adding regular low dose inhaled corticosteroid (ICS) for patients at risk of exacerbations

Step 2 – Low dose controller + as-needed SABA

- Preferred option: regular low dose ICS with as-needed inhaled SABA
  - Low dose ICS reduces symptoms and reduces risk of exacerbations and asthma-related hospitalization and death
- Other options
  - Leukotriene receptor antagonists (LTRA) with as-needed SABA
    - Less effective than low dose ICS
    - May be used for some patients with both asthma and allergic rhinitis, or if patient will not use ICS
  - Combination low dose ICS/long-acting beta$_2$-agonist (LABA) with as-needed SABA
    - Reduces symptoms and increases lung function compared with ICS
    - More expensive, and does not further reduce exacerbations
  - Intermittent ICS with as-needed SABA for purely seasonal allergic asthma with no interval symptoms
    - Start ICS immediately symptoms commence, and continue for 4 weeks after pollen season ends

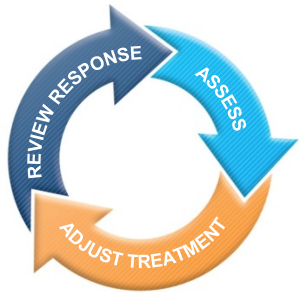
Step 3 – one or two controllers + as-needed inhaled reliever

- Before considering step-up
  - Check inhaler technique and adherence, confirm diagnosis
- Adults/adolescents: preferred options are either combination low dose ICS/LABA maintenance with as-needed SABA, OR combination low dose ICS/formoterol maintenance and reliever regimen*
  - Adding LABA reduces symptoms and exacerbations and increases FEV_1, while allowing lower dose of ICS
  - In at-risk patients, maintenance and reliever regimen significantly reduces exacerbations with similar level of symptom control and lower ICS doses compared with other regimens
- Children 6-11 years: preferred option is medium dose ICS with as-needed SABA
- Other options
  - Adults/adolescents: Increase ICS dose or add LTRA or theophylline (less effective than ICS/LABA)
  - Adults: consider adding SLIT (see Non-pharmacological interventions)
  - Children 6-11 years – add LABA (similar effect as increasing ICS)

UPDATED 2017

*Approved only for low dose beclometasone/formoterol and low dose budesonide/formoterol

Reviewing response and adjusting treatment



- How often should asthma be reviewed?
  - 1-3 months after treatment started, then every 3-12 months
  - During pregnancy, every 4-6 weeks
  - After an exacerbation, within 1 week
- Stepping up asthma treatment
  - *Sustained step-up*, for at least 2-3 months if asthma poorly controlled
    - Important: first check for common causes (symptoms not due to asthma, incorrect inhaler technique, poor adherence)
  - *Short-term step-up*, for 1-2 weeks, e.g. with viral infection or allergen
    - May be initiated by patient with written asthma action plan
  - *Day-to-day adjustment*
    - For patients prescribed low-dose ICS/formoterol maintenance and reliever regimen*
- Stepping down asthma treatment
  - Consider step-down after good control maintained for 3 months
  - Find each patient's minimum effective dose, that controls both symptoms and exacerbations

*Approved only for low dose beclometasone/formoterol and low dose budesonide/formoterol

Indications for considering referral, where available

- Significant side-effects (or risk of side-effects)
  - Significant systemic side-effects
  - Need for oral corticosteroids long-term or as frequent courses
- Symptoms suggesting complications or sub-types of asthma
  - Nasal polyposis and reactions to NSAIDS (may be aspirin exacerbated respiratory disease)
  - Chronic sputum production, fleeting shadows on CXR (may be allergic bronchopulmonary aspergillosis)
- Additional reasons for referral in children 6-11 years
  - Doubts about diagnosis, e.g. symptoms since birth
  - Symptoms or exacerbations remain uncontrolled
  - Suspected side-effects of treatment, e.g. growth delay
  - Asthma with confirmed food allergy

Guided asthma self-management and skills training

Essential components are:

- Skills training to use inhaler devices correctly
- Encouraging adherence with medications, appointments
- Asthma information
- Guided self-management support
  - Self-monitoring of symptoms and/or PEF
  - Written asthma action plan
  - Regular review by a health care provider

Provide hands-on inhaler skills training

Choose

- Choose an appropriate device before prescribing. Consider medication options, arthritis, patient skills and cost. For ICS by pMDI, prescribe a spacer
- Avoid multiple different inhaler types if possible

Check

- Check technique at every opportunity – "*Can you show me how you use your inhaler at present?*"
- Identify errors with a device-specific checklist

Correct

- Give a physical demonstration to show how to use the inhaler correctly
- Check again (up to 2-3 times)
- Re-check inhaler technique frequently, as errors often recur within 4-6 weeks

Confirm

- Can you demonstrate correct technique for the inhalers you prescribe?
- Brief inhaler technique training improves asthma control

Check adherence with asthma medications

- Poor adherence:
  - Is very common: it is estimated that 50% of adults and children do not take controller medications as prescribed
  - Contributes to uncontrolled asthma symptoms and risk of exacerbations and asthma-related death
- Contributory factors
  - Unintentional (e.g. forgetfulness, cost, confusion) and/or
  - Intentional (e.g. no perceived need, fear of side-effects, cultural issues, cost)
- How to identify patients with low adherence:
  - Ask an empathic question, e.g. "*Do you find it easier to remember your medication in the morning or the evening?*", or "*Would you say you are taking it 3 days a week, or less, or more?*"
  - Check prescription date, label date and dose counter
  - Ask patient about their beliefs and concerns about the medication

‘Guided self-management education’

- Highly effective in improving asthma outcomes
  - Reduced hospitalizations, ED visits, symptoms, night waking, time off work, improved lung function and quality of life
- Three essential components
  - Self-monitoring of symptoms and/or PEF
  - Written asthma action plan
    - Describe how to recognize and respond to worsening asthma
    - Individualize the plan for the patient’s health literacy and autonomy
    - Provide advice about a change in ICS and how/when to add OCS
    - If using PEF, base action plan on personal best rather than predicted
  - Regular medical review

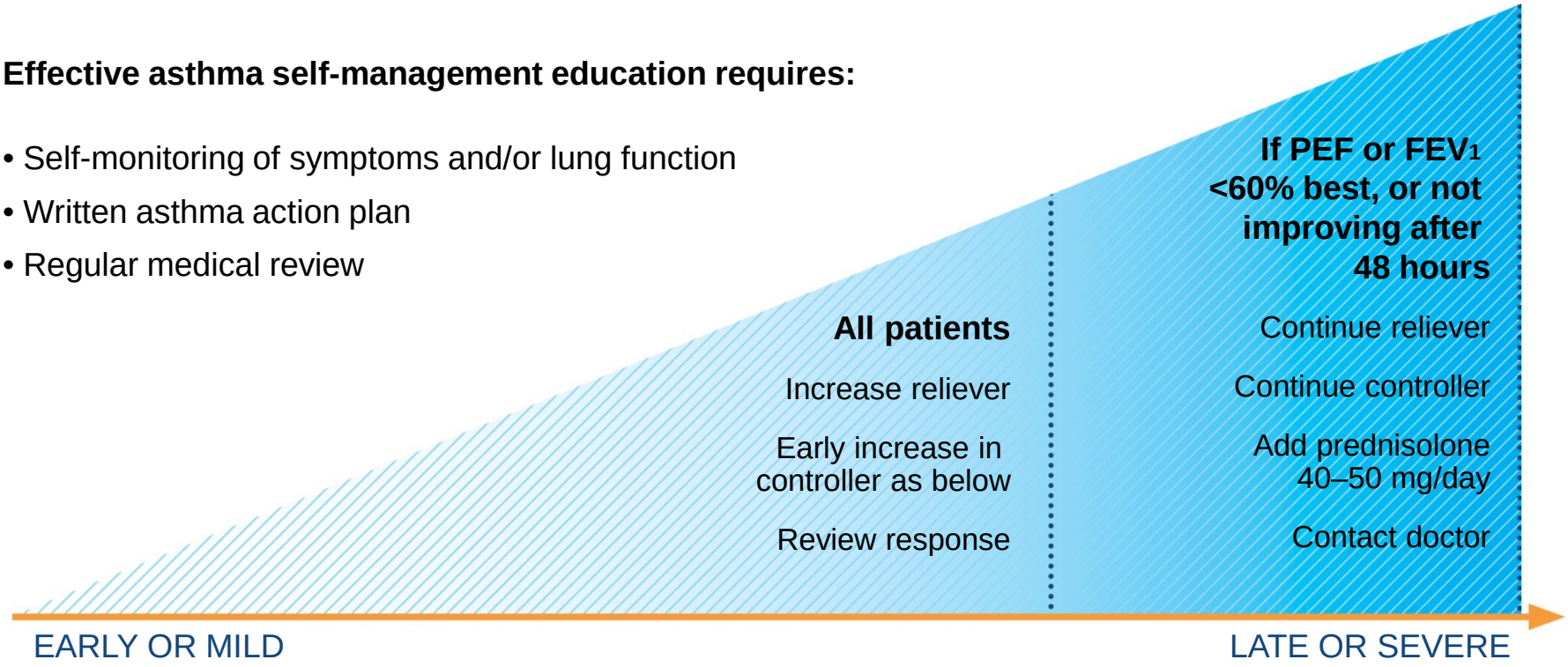
Identify patients at risk of asthma-related death

- Patients at increased risk of asthma-related death should be identified
  - Any history of near-fatal asthma requiring intubation and ventilation
  - Hospitalization or emergency care for asthma in last 12 months
  - Not currently using ICS, or poor adherence with ICS
  - Currently using or recently stopped using OCS
    - (indicating the severity of recent events)
  - Over-use of SABAs, especially if more than 1 canister/month
  - Lack of a written asthma action plan
  - History of psychiatric disease or psychosocial problems
  - Confirmed food allergy in a patient with asthma
- Flag these patients for more frequent review

Written asthma action plans

Effective asthma self-management education requires:

- Self-monitoring of symptoms and/or lung function
- Written asthma action plan
- Regular medical review

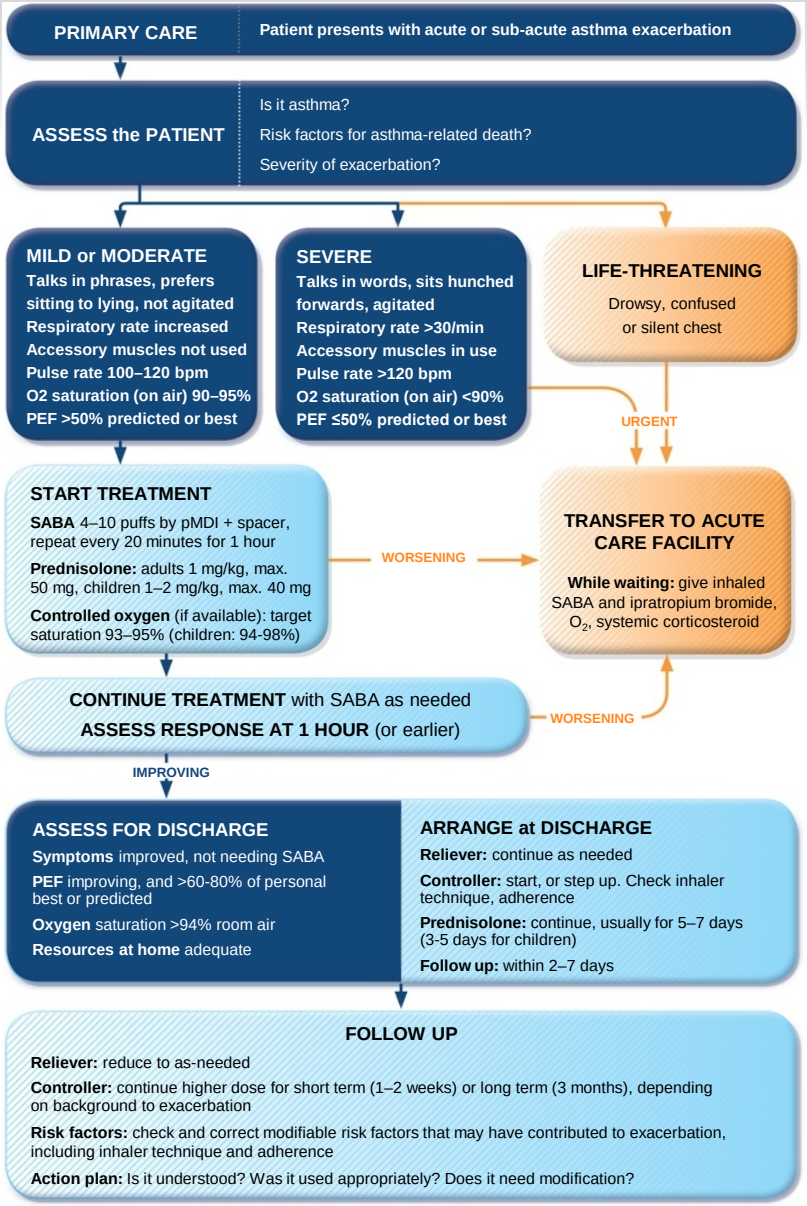


Written asthma action plans – medication options

- Increase inhaled reliever
  - Increase frequency as needed
  - Adding spacer for pMDI may be helpful
- Early and rapid increase in inhaled controller
  - Up to maximum ICS of 2000mcg BDP/day or equivalent
  - Options depend on usual controller medication and type of LABA
  - See GINA 2017 report Box 4-2 for details
- Add oral corticosteroids if needed
  - Adults: prednisolone 1mg/kg/day up to 50mg, usually 5-7 days
  - Children: 1-2mg/kg/day up to 40mg, usually 3-5 days
  - Morning dosing preferred to reduce side-effects
  - Tapering not needed if taken for less than 2 weeks
  - Remember to advise patients about common side-effects (sleep disturbance, increased appetite, reflux, mood changes)

UPDATED 2017

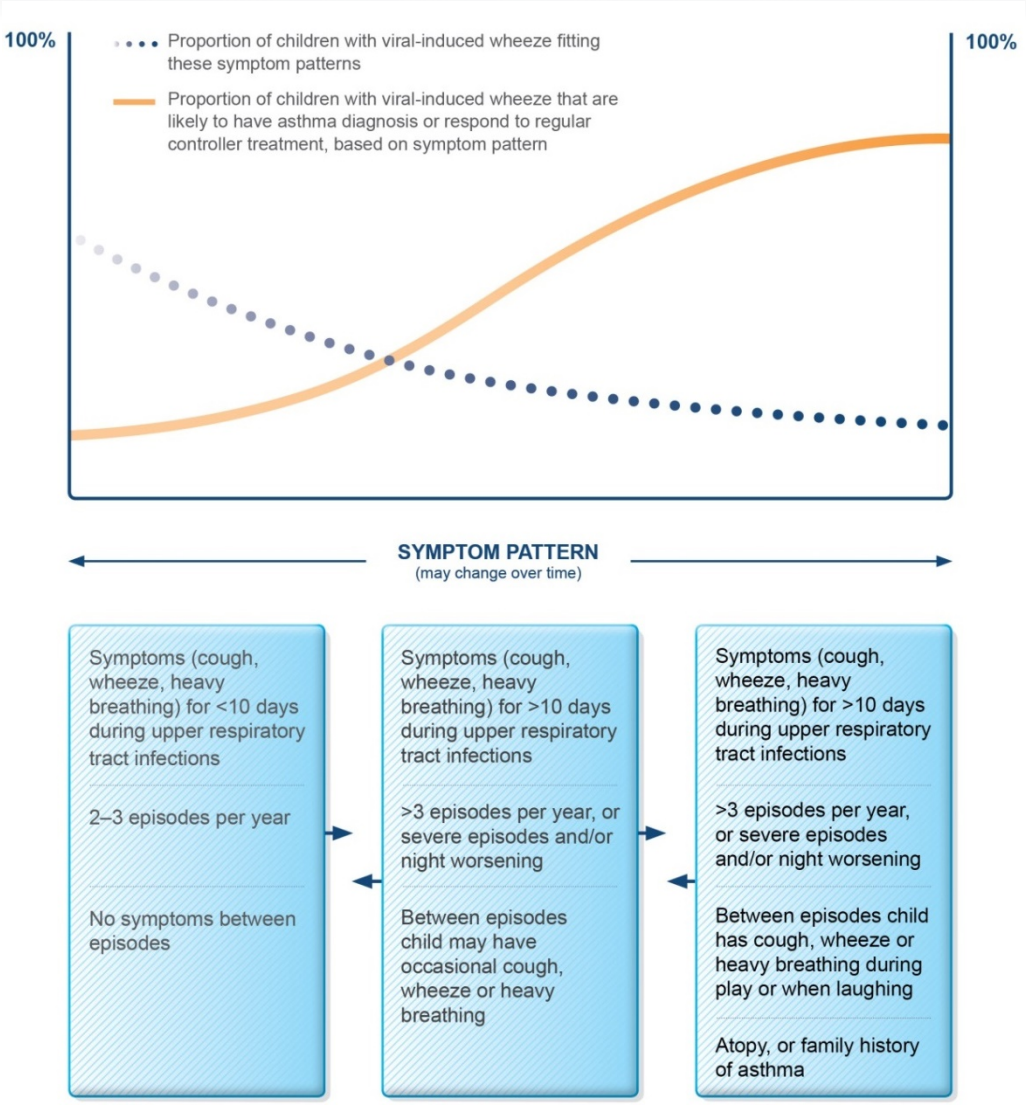
Managing exacerbations in primary care



Diagnosis and management of asthma in children 5 years and younger

GINA Global Strategy for Asthma Management and Prevention 2017

Probability of asthma diagnosis or response to asthma treatment in children ≤5 years



Features suggesting asthma in children ≤5 years

Feature	Characteristics suggesting asthma
Cough  	Recurrent or persistent non-productive cough that may be worse at night or accompanied by some wheezing and breathing difficulties. Cough occurring with exercise, laughing, crying or exposure to tobacco smoke in the absence of an apparent respiratory infection Prolonged cough in infancy, and cough without cold symptoms, are associated with later parent-reported physician-diagnosed asthma, independent of infant wheeze
Wheezing	Recurrent wheezing, including during sleep or with triggers such as activity, laughing, crying or exposure to tobacco smoke or air pollution
Difficult or heavy breathing or shortness of breath	Occurring with exercise, laughing, or crying
Reduced activity	Not running, playing or laughing at the same intensity as other children; tires earlier during walks (wants to be carried)
Past or family history	Other allergic disease (atopic dermatitis or allergic rhinitis) Asthma in first-degree relatives
Therapeutic trial with low dose ICS and as-needed SABA	Clinical improvement during 2–3 months of controller treatment and worsening when treatment is stopped

Common differential diagnoses of asthma in children ≤5 years

Condition	Typical features
Recurrent viral respiratory infections	Mainly cough, runny congested nose for <10 days; wheeze usually mild; no symptoms between infections
Gastroesophageal reflux	Cough when feeding; recurrent chest infections; vomits easily especially after large feeds; poor response to asthma medications
Foreign body aspiration	Episode of abrupt severe cough and/or stridor during eating or play; recurrent chest infections and cough; focal lung signs
Tracheomalacia or bronchomalacia	Noisy breathing when crying or eating, or during URTIs; harsh cough; inspiratory or expiratory retraction; symptoms often present since birth; poor response to asthma treatment
Tuberculosis	Persistent noisy respirations and cough; fever unresponsive to normal antibiotics; enlarged lymph nodes; poor response to BD or ICS; contact with someone with TB
Congenital heart disease	Cardiac murmur; cyanosis when eating; failure to thrive; tachycardia; tachypnea or hepatomegaly; poor response to asthma medications

Common differential diagnoses of asthma in children ≤5 years (continued)

Condition	Typical features
Cystic fibrosis	Cough starting shortly after birth; recurrent chest infections; failure to thrive (malabsorption); loose greasy bulky stools
Primary ciliary dyskinesia	Cough and recurrent mild chest infections; chronic ear infections and purulent nasal discharge; poor response to asthma medications; situs inversus (in ~50% children with this condition)
Vascular ring	Respirations often persistently noisy; poor response to asthma medications
Bronchopulmonary dysplasia	Infant born prematurely; very low birth weight; needed prolonged mechanical ventilation or supplemental oxygen; difficulty with breathing present from birth
Immune deficiency	Recurrent fever and infections (including non-respiratory); failure to thrive

GINA assessment of asthma control in children ≤5 years

A. Symptom control

In the past 4 weeks, has the child had:		Level of asthma symptom control		
		Well-controlled	Partly controlled	Uncontrolled
• Daytime asthma symptoms for more than few minutes, more than once/week?	Yes ❑ No ❑	None of these	1-2 of these	3-4 of these
• Any activity limitation due to asthma? (runs/plays less than other children, tires easily during walks/playing)	Yes ❑ No ❑			
• Reliever needed* more than once a week?	Yes ❑ No ❑			
• Any night waking or night coughing due to asthma?	Yes ❑ No ❑			

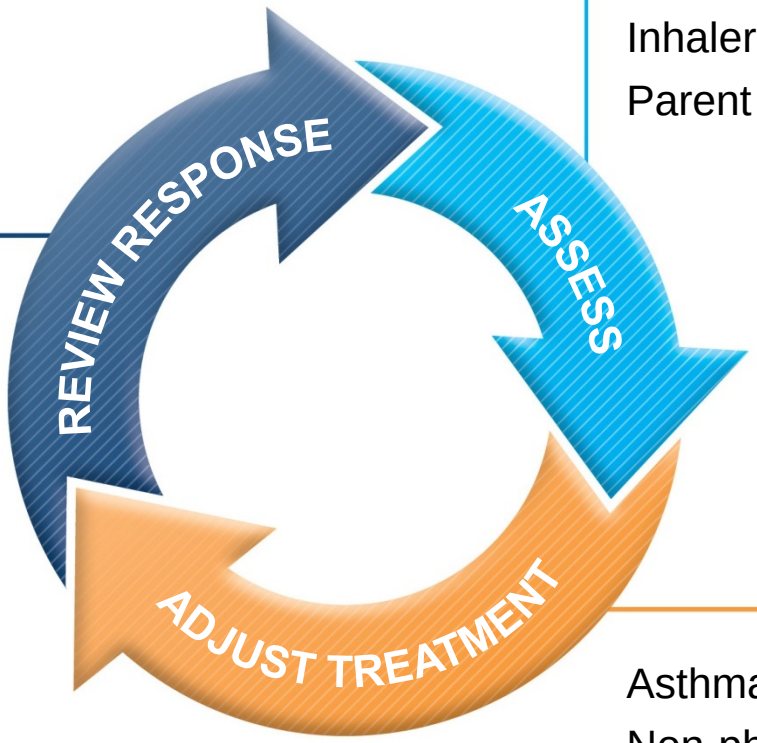
B. Risk factors for poor asthma outcomes

ASSESS CHILD'S RISK FOR:

- Exacerbations within the next few months
- Fixed airflow limitation
- Medication side-effects

Control-based asthma management cycle in children ≤5 years

Diagnosis
Symptom control & risk factors
Inhaler technique & adherence
Parent preference



Symptoms
Exacerbations
Side-effects
Parent satisfaction

Asthma medications
Non-pharmacological strategies
Treat modifiable risk factors

Stepwise approach – key issues (children ≤5 years)

UPDATED 2017

KEY ISSUES

ALL CHILDREN

- **Assess** symptom control, future risk, comorbidities
- **Self-management:** education, inhaler skills, written asthma action plan, adherence
- **Regular review:** assess response, adverse events, establish minimal effective treatment
- (Where relevant): environmental control for smoke, allergens, indoor/outdoor air pollution

- Assess asthma control
  - Symptom control, future risk, comorbidities
- Self-management
  - Education, inhaler skills, written asthma action plan, adherence
- Regular review
  - Assess response, adverse events, establish minimal effective treatment
  - Record height each year, as poorly-controlled asthma may influence growth, and ICS may be associated with growth delay in first 1-2 years
- Other
  - (Where relevant): environmental control for smoke, allergens, indoor or outdoor air pollution

Step 1 (children ≤5 years) – as-needed inhaled SABA

- Preferred option: as-needed inhaled SABA
  - Provide inhaled SABA to all children who experience wheezing episodes
  - Not effective in all children
- Other options
  - Oral bronchodilator therapy is not recommended (slower onset of action, more side-effects)
  - For children with intermittent viral-induced wheeze and no interval symptoms, if as-needed SABA is not sufficient, consider intermittent ICS. Because of the risk of side-effects, this should only be considered if the physician is confident that the treatment will be used appropriately.

Children aged ≤5 years – key changes

- Step 2 (initial controller treatment) for children with frequent viral-induced wheezing and with interval asthma symptoms
  - A trial of regular low-dose ICS should be undertaken first
  - As-needed (prn) or episodic ICS may be considered
  - The reduction in exacerbations seems similar for regular and high dose episodic ICS *(Kaiser Pediatr 2015)*
  - LTRA is another controller option
- Step 3 (additional controller treatment)
  - First check diagnosis, exposures, inhaler technique, adherence
  - Preferred option is medium dose ICS
  - Low-dose ICS + LTRA is another controller option
    - Blood eosinophils and atopy predict greater short-term response to moderate dose ICS than to LTRA *(Fitzpatrick JACI 2016)*
    - Relative cost of different treatment options in some countries may be relevant to controller choices

Step 2 (children ≤5 years) – initial controller + as-needed SABA

- Indication
  - Child with symptom pattern consistent with asthma, and symptoms not well-controlled, or ≥3 exacerbations per year
  - May also be used as a diagnostic trial for children with frequent wheezing episodes
- Preferred option: regular daily low dose ICS + as-needed inhaled SABA
  - Give for ≥3 months to establish effectiveness, and review response
- Other options depend on symptom pattern
  - (Persistent asthma) – regular leukotriene receptor antagonist (LTRA) leads to modest reduction in symptoms and need for OCS compared with placebo
  - (Intermittent viral-induced wheeze) – regular LTRA improves some outcomes but does not reduce risk of exacerbations
  - (Frequent viral-induced wheeze with interval symptoms) – consider episodic or as-needed ICS, but give a trial of regular ICS first

Inhaled corticosteroids and growth in children

NEW SLIDE 2017

- Discuss decisions about controller treatment with parents/carers
  - Discuss the relative benefits and risks of treatment/no treatment
  - Emphasize the importance of maintaining normal activity levels for normal physical and social development
- ICS can have a small but usually temporary effect on growth
  - An effect of ICS on growth velocity is seen in pre-pubertal children in the first 1-2 years of treatment
  - This is not progressive or cumulative *[Kelly 2012, Loke 2015]*.
  - The one study that examined long-term outcomes showed a difference of only 0.7% in adult height *[Kelly 2012, Loke 2015]*
- Poorly-controlled asthma itself adversely affects adult height *[Pedersen 2001]*
- For more detail see GINA 2017 Appendix Chapter 5B

Step 3 (children ≤5 years) – medium dose ICS + as-needed inhaled SABA

- Indication
  - Asthma diagnosis, and symptoms not well-controlled on low dose ICS
  - First check symptoms are due to asthma, and check adherence, inhaler technique and environmental exposures
- Preferred option: medium dose ICS with as-needed inhaled SABA
  - Review response after 3 months
- Other options
  - Consider adding LTRA to low dose ICS (based on data from older children)

Step 4 (children ≤5 years) – refer for expert assessment

- Indication
  - Asthma diagnosis, and symptoms not well-controlled on medium dose ICS
  - First check symptoms are due to asthma, and check adherence, inhaler technique and environmental exposures
- Preferred option: continue controller treatment and refer for expert assessment
- Other options (preferably with specialist advice)
  - Higher dose ICS and/or more frequent dosing (for a few weeks)
  - Add LTRA, ~~theophylline~~, low dose OCS (for a few weeks only)
  - Add intermittent ICS to regular daily ICS if exacerbations are the main problem
  - ICS/LABA not recommended in this age group

Children aged ≤5 years – key changes

- Home management of intermittent viral-triggered wheezing
  - Preemptive episodic high-dose episodic ICS may reduce progression to exacerbation *(Kaiser Pediatr 2016)*
  - However, this has a high potential for side-effects, especially if continued inappropriately or is given frequently
  - Family-administered high dose ICS should be considered only if the health care provider is confident that the medications will be used appropriately, and the child closely monitored for side-effects
- Emergency department management of worsening asthma
  - Reduced risk of hospitalization when OCS are given in the emergency department, but no clear benefit in risk of hospitalization when given in the outpatient setting *(Castro-Rodriguez Pediatr Pulm 2016)*

Primary prevention of asthma

- The development and persistence of asthma are driven by gene-environment interactions
- For children, a ‘window of opportunity’ exists *in utero* and in early life, but intervention studies are limited
- For intervention strategies including allergen avoidance
  - Strategies directed at a single allergen have not been effective
  - Multifaceted strategies may be effective, but the essential components have not been identified
- Current recommendations are
  - Avoid exposure to tobacco smoke in pregnancy and early life
  - Encourage vaginal delivery
  - Advise breast-feeding for its general health benefits
  - Where possible, avoid use of paracetamol (acetaminophen) and broad-spectrum antibiotics in the first year of life

the end!

- Thank you!

- Questions?